NOVEMBER/DECEMBER 1990

THE AMATEUR ELECTRONIC COMMUNICATIONS MAGAZINE

BEAM

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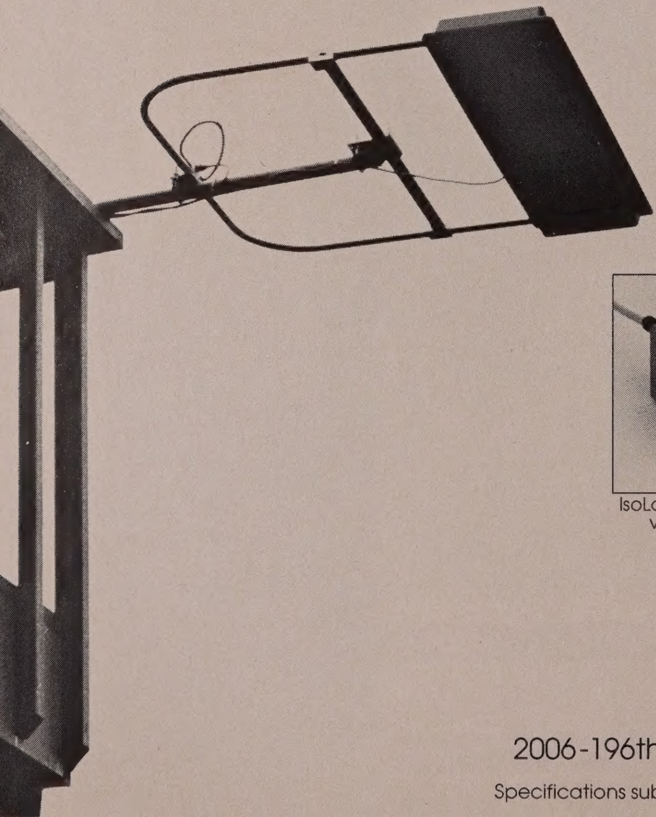

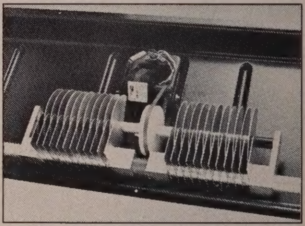

IsoLoop precision stepper motor provides accurate tuning.

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IsoLoop LC-1 control box with variable speed tuning.

Revolutionary. The AEA IsoLoop antenna represents years of research and development. Others may try to imitate the IsoLoop, but none can match the patent-pending design.

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COVER: Linden Keal in the control room at K3LVA AM and FM, Dick Greene's amateur radio station. Photograph by Grant Gordon.

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BEAM (ISSN 1052-4940) is a bi-monthly publication of Seven Mountains Scientific, Inc., P.O. Box 650, Boalsburg, PA 16827, U.S.A.
Phone and FAX (814) 466-6559

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Vol. 1 No. 3

ARTICLES

5 **Getting Young People into Amateur Radio**
by Karen D. Young, N0LJZ
Show a youngster the excitement and rewards of Amateur Radio.

8 **Reducing Drift in Homebrew VFO's**
by John Pivnichny, N2DCH
By and large VFO's should not vary on their own.

15 **A Key to the Past**
by Bob Cutter, KI0G
What is it worth to hold a key to the past?

17 **Field Déjà Vu**
by John Telford, W3TJ
Sandwiches soaked with gasoline. Beer for breakfast. That's livin'.

19 **The Junk Box Cathode Modulator**
by Charlie Tiemeyer, W3RMD
Voice communications -- no power supply and no rig modification.

22 **Resonance**
by Bill Richardson, W3IMG
Bill gets into the swing of things with Q and such.

DEPARTMENTS

4 QSL's
5 OPERATING SHACK
8 HIGH-TECH TOPICS
15 OLDTIMER'S SOAPBOX
18 PRODUCT NEWS
19 HOME BREWERY
21 ELECTRONICS EMPORIUM
22 BACK TO BASICS

QSL's

How about publishing things on how to get new people interested in amateur radio?

Robert S. Antoniuk, N2SU
Clifton, NJ

[Check out our first article, on the facing page.]

Liked the "EZ40 Receiver" [July/August issue]. How about a companion NE-602-based QRP transmitter?

Bob Cromwell, KC9RG
West Lafayette, IN

[Watch our January/February issue for Rod Kreuter's "EZ40 Transmitter" with digital parts rather than the more difficult-to-find rf parts.]

Look forward to seeing your magazine.

Herbert Eldert, Jr., KE2KX
Scotch Plains, NJ

Really enjoyed "EZ40" and "Reminiscences of an OM" in your July/August issue. Thanks for a good mag.

Marv Holmes, W0YHE
Newport, MN

July/August issue very informative. I especially liked the code computer program.

Rosalene M. Victor, K8YL
Shinnston, WV

I finally got my complimentary copy back after circulating among local hams. The verdict was rave reviews: clear, concise, easily understood writing; clean, uncluttered layout; and nice cover graphics. Wish you well!

Rich Jacovino, NT1I
Waterbury, CT

If BEAM is going to be a free publication, a format similar to *RF Design* or *Microwave Journal,* except for ham radio stuff, would be fun to read. You know, articles on cute design tricks, product reviews, tutorials and lots of advertisements. Good luck!

John Bellantoni, WB1ALZ
Palo Alto, CA

I've been reading free professional technical journals for 25 years, so I think your concept is GREAT! I wish you lots of success with your endeavor.

James Wilcox, K4JAP
Falls Church, VA

Your "Back to Basics" looks good. Believe me it's needed. "Operating Shack" OK too. Very nice format. Good work, folks! I wish you much success!

Bob Morris, N7RM
Mulino, OR

Here are BEAM applications from 15 handicapped students and one instructor (W8IQJ) of the Courage Handi-Ham System. We just completed the 1990 Minnesota Radio Camp. This would make an excellent story.

Ralph Andrea, W0FCO
St. Paul, MN

[We'd be happy to consider it for a future issue.]

Good luck on your new magazine. Sounds like a fine idea. One suggestion -- find a better name.

James P. Dux, K3JD
Lancaster, PA

[It took us a long time to come up with the name BEAM!]

I'd like to learn some simple Russian phrases in CW anyone could use!!

S.W. Head, K8OI
Toledo, OH

I need to get by local ordinances and covenants, sell my wife, and get a beam on the air -- HELP!

Larry B. Keese, KC7QN
Rolling Hills Estate, CA

[What's the going price for a wife these days?]

I am in the V.E. program and try to Elmer for prospective new hams. We're losing the youth to other hobbies!

Arie D. Cook, K4IB
Port Charlotte, FL

I like your magazine.

James Cortner Jr., WD4BKV
Wartrace, TN

I see nothing wrong with the presentation in this issue. Keep up the good work.

William E. Cornelius, K4IMQ
Guntersville, AL

I'm planning a seven-day DXpedition to VP5 Turks and Caicos Island from November 28 to December 5, 1990. The six operators will be me, Ed (WB8MQJ), Ed (NY8E), Al (W4ZQB), Jack (WD4JWO), and SWL Dick on 6 to 160 meters, SSB and CW. We'll operate on regular DX frequencies. Any questions contact me, WB8GEX, at 1894 Old Oxford Rd., Hamilton, OH 45013, phone (513) 896-9990 or FAX (513) 863-8131.

Joe Pater, WB8GEX
Hamilton, OH

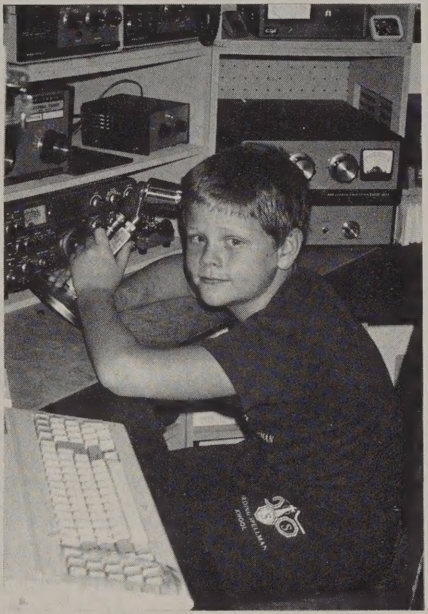
Getting Young People Into Amateur Radio

by Karen D. McIntyre, N0LJZ

Once upon a time and not so long ago, amateur radio was a young man's hobby. Now it is increasingly an old timer's preserve. What happened to the kids of twenty, thirty, forty years ago? The ones who wound coils on oatmeal boxes, scrounged for old TV parts, and somehow got an acceptable signal on the air? And why now, when it is easier than ever to put together a professional station, is it harder than ever to attract new hams?

There are several reasons for this. One is the almost total disappearance of shortwave listening, which used to attract many non-hams gently into amateur radio. Amazingly enough, most people don't know that they can get Radio Moscow, the BBC, or Vatican Radio right in their own living rooms. And most young people don't realize that anything but FM radio even exists.

A second reason is the cost and complexity of radio equipment. In days gone by a young person would start out with a simple receiver and then gradually add more pieces of equipment until he had a complete station. At no point was he making a big investment in something way over his technical head, although at the end he wound up with a lot of money sunk in his station. But today it seems one has to just jump off the deep end with an all-in-one SSB transceiver. They are actually cheaper than the separate units of yesterday, but try explaining that to the parent who sees amateur radio as just another burst of adolescent enthusiasm like the tuba, the Nintendo, the guitar, and the four RC model airplanes gathering dust in a closet.



The author's son Jesse, N0MKT, age 10, in the family ham shack. He got his technician ticket last summer while he was still 9.

The number of amateur radio operators in this country is declining. That is a fact. What we do about it is up to us. We can bemoan the situation and sit back and watch our numbers and privileges decline. Or we can get out there and bring new people into our ranks. Much is being done on a local club level these days to start novice classes and entice adults to become hams. This is great. But little is being done to interest the young people in amateur radio. This is not great. If we want to insure a bright future for amateur radio, then we need to involve the children.

There is no one simple solution to the problem. Rather it is a matter of using anything that works to make the world of ham radio visible to kids, to spark their interest, and then get them involved. So how do we do this? It is not as difficult as you might think, but it does require some effort on our part.

As a teacher and a mom I have a different perspective on amateur radio than most hams. Three out of four of us in our family are hams, and many family activities involve the radio. Ever since they could crawl our children have had free access to the ham shack, though the knobs and buttons were off limits! Instead we gave them old non-functioning CB's and keyers and let them do whatever they wanted with them. Sometimes they just pushed the buttons; other times the wire cutters were brought into play. The point is, they have always been around amateur radio so it seems natural to them to pick up a mike or a soldering iron.

I see four areas where we as hams can involve ourselves with getting children interested in amateur radio. They are the home front, ham clubs, Scouts and school, and hamfests. I challenge you to invest a little of your time in one or more of these areas.

On The Home Front

First, let's examine the potential source of new hams right at our fingertips -- or rather right underfoot. What better source than our own children? They at least know that amateur radio exists. But why does it often seem that our own kids are just not interested?

Stop for a minute and examine your own station. It is the rare one that is not located either in the garage or basement -- anywhere to keep the noise from interfering with the rest of the family. The station becomes a place apart where Dad or Mom goes and does weird things with equally weird boxes with funny knobs and dials. We need to bring our ham shacks into the mainstream of our family, not necessarily into the formal living room, but remove the place-apart stigma.

It's never too early to start. Here, Jesse McIntyre is "helping" in the work shop at age 20 months, in 1982.

Now imagine what a small child sees when Mom or Dad is on the air. He or she sees the back of a head and shoulders hunched over those same weird-looking boxes that are now making loud squawking noises. And for hours on end nothing comprehensible can be heard. What kid would want to emulate Dad or Mom and become a ham having watched that exciting spectacle? While the lights and noises may entertain for a while, it would be better to explain what the odd-looking boxes do -- but keep the explanations simple. Only the most precocious preschooler can comprehend Ohm's law! Let them help log a contest sometime or pass parts when a construction project is under way. Hands-on-experience beats observation every time!

Getting one's own children interested in amateur radio is rather like exposing them to chicken pox. They can be exposed to the virus for years, but whether or not they develop spots is another matter. We can expose our children to ham radio, but not all of them will catch the "bug." And that's fine. Whatever you do, do not push them to become hams! It won't work! My eight-year-old daughter adamantly refused to even play with the code. And then her nine-year-old brother got his ham license. This evening I found her in the ham shack trying to teach the code to one of our cats!

If we want to get our kids involved, we also have to get our spouses involved. I do not mean that every spouse must get his or her license. That is unrealistic. However, spouses need to be knowledgeable enough about amateur radio to at least understand what the hams are saying. Grudging tolerance is not enough. Besides, you might be surprised at how much fun it really is if you give it a chance. The only reason I am a ham today is because KB6IC handed me a soldering iron to "hold" one night while we were dating. He got the iron back, but only after the radio kit was done. By then I was hooked.

Ham Clubs

Second, our local ham clubs have an important part to play in getting young people into ham radio. Most clubs have a Christmas party for the families, but more is needed to get the kids involved in the RADIO part of amateur radio. Involve the family in club activities such as Field Day. Encourage families to camp out too, and involve the kids in any way you can.

At the monthly ham club meeting, set up activities for children. No, I do not mean coloring books and clay in a quiet corner! Give the kids some hands-on experiences that are electronic or radio in nature. Let them build a buzzer, a switch, or even a simple keyer. It need not be expensive either. Scrounge the parts from the overflowing junk boxes of the club members, or get a parts store to donate them. Bring in different keyers or bugs for them to try, then sneak a little code session in when they are aren't looking. You will end up with some young people who are interested in amateur radio. Ham club meetings will become family affairs.

Scouts and School

Third, we are missing a real chance to get young people interested in ham radio when we do not reach out to our local Scout groups and schools.

Every October there is a Scout ham activity called Jamboree on the Air. Hams around the world fire up their rigs and invite groups of Scouts into their shacks to talk around the world. The Scouts can get special QSL cards and patches for their participation.

While the Scouts publicize the event in *their* publications, the ham community does little. This means that few hams even know about the Jamboree. What a great chance to spark some interest.

Two years ago KB6IC and I had our son's Cub Scout pack over for the Jamboree. The boys were able to talk to both U.S. coasts, to the USS Wisconsin (in drydock), and to Europe. They all received QSL cards and certificates from their contacts, and to this day they mention how much they enjoyed that day. One of the boys even convinced his dad to get a shortwave radio so he can listen to the world.

The Jamboree on the Air is not the only Scout activity in which we could get involved. The Boy Scouts have two different merit badges for Signaling and Radio. The Cub Scouts have activity badges for Radio, Electricity, and Communication that involve codes, communications, electronics, and electricity. Contact your local p pack and troop leaders and offer your assistance.

Girl Scouts and Brownies also have badges and awards that involve codes and foreign countries. A girl will make just as good a ham as a boy, though it may take a little more effort to get the girls involved in what is perceived as a male hobby.

Get involved with your local schools. Most elementary schools have a career day or some such excuse for you to take in your rig and set up a station. Social studies classes are studying the world, so let them talk to it! The science classes give you a perfect chance to share a little electronics and radio theory. And kids will be interested.

Look into the possibility of starting a ham club in local junior and senior high schools. It's an ideal way to get on the air. When faced with the high cost of setting up a home station, any sane parent would discourage their child's interest in ham radio. That same parent would likely support that interest if the child had access to a "free" school station. A school club could be set up cheaply enough with donated equipment and just a small investment of time. The kids won't come to us, because most of them, unless they are from a "ham family" or have friends who are, don't know we exist. We have to reach out to them.

Lew McIntyre, KB6IC, introduced Cub Scout Pack 352 of Bellevue, Nebraska, to Jamboree on the Air in 1988. The boys talked to the East and West coasts, Europe, and the USS Wisconsin.

At the Hamfest

Fourth, let's use the hamfest as a means to excite young people and get them involved in ham radio. Children are barely tolerated at most hamfests. Dealers and vendors glare at them if they get within three feet of the tables, and all the poor kids can do is wander around in their parents' wake getting more bored and turned off by the minute.

Organize radio and electronic activities for the kids. While the parent hams browse and ogle and attend seminars, the kids could be involved in something more their speed. Things like FUN code sessions, building simple circuits or kits, actually using a radio, building an antenna, slow scan TV, or making a video movie -- not kid-sitting, but things to spark their interest so that they will come away from the hamfest excited instead of bored and grumpy. They will learn enough to be able to browse intelligently with their parents, and with luck a few new hams will result.

Remember, it is up to us to ensure the future of amateur radio by bringing new hams into the hobby. No one else is going to do it for us. Definitely continue the efforts to interest adults, but don't forget the young people. We will all benefit from the effort.

When not out there getting Omaha-area youngsters fired up about amateur radio, Karen, Lew, and Jesse McIntrye are firing up their rigs at 3711 Gayle Ave., Bellevue, NE 68123.

HIGH-TECH TOPICS

Reducing Drift in Homebrew VFO's

by John Pivnichny, N2DCH

Measuring drift in VFO's is a time-consuming procedure. This article lists techniques and circuits for reducing VFO drift. Results of actual experimental measurements made over a period of several months are shown in the graphs. With this information the amateur can build stable VFO's without having to take many drift measurements.

Theory

The frequency of a VFO is controlled by the inductance and capacitance, including stray reactances, of the tank circuit.

$$f = \frac{1}{2\pi\sqrt{LC}} \qquad (1)$$

If the inductance L or Capacitance C increases by a small amount, say 100 parts per million (ppm), then frequency decreases by half that number of ppm. The minus half is due to the square root in the denominator of Equation 1. The actual drift will depend on the operating frequency of the VFO. Let's say you have a VFO setting at 5 MHz and you want it to drift less than 1 kHz. That's:

$$\frac{1\times10^3 Hz}{5\times10^6 Hz} = \frac{0.2\times10^3}{10^6} \qquad (2)$$

or 200 ppm. Then if you had a zero drift capacitor, the inductor could drift 400 ppm, or if the inductor was perfect the capacitor could drift 400 ppm. Any combination of the two elements varying is also possible, e.g., the capacitor could drift 100 ppm and the inductor 300 ppm. Note that it is also possible for the drift of the inductor to be canceled out by the drift of the capacitor if one goes positive and the other negative. This only works out in practice if they drift at the same time; if one drifts first, then you will first have a frequency shift in one direction then back as the canceling drift comes into play.

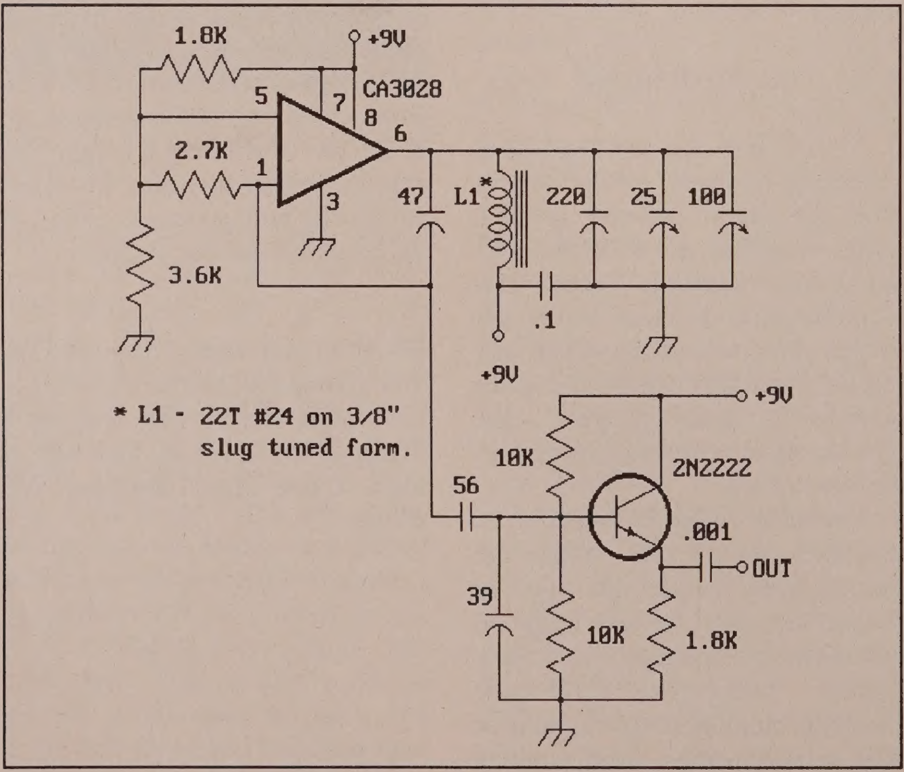
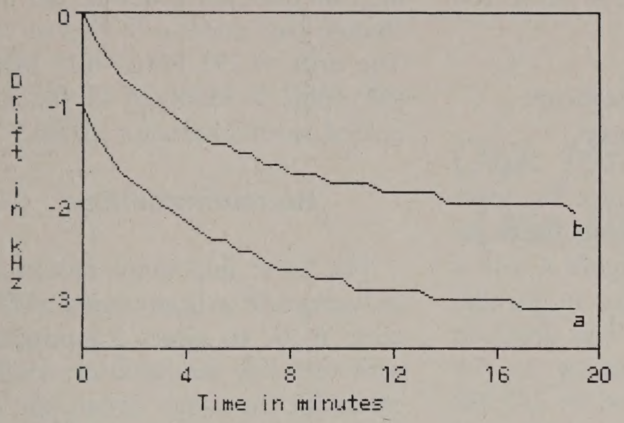


Figure 1. 5.5 MHz VFO

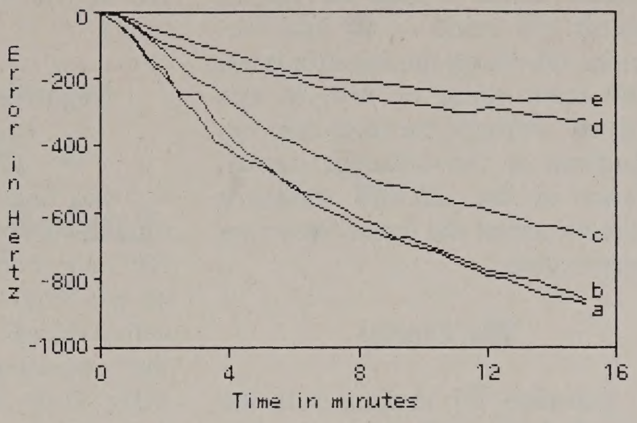
Measurements

My first drift measurements were taken on the circuit shown in Figure 1 operating at 5.5 MHz. I used a slug-tuned coil with a powdered iron slug of unknown characteristics and silver mica capacitors in the tank circuit. Frequency readings were taken with a homebrew frequency counter every minute for twenty minutes starting from a cold (room temperature) start. See the results in the upper trace in Figure 2. This drift of 2



a -- type 6 toroid
b -- slug-tuned coil

Figure 2. Drift at 5.5 MHz



a, b -- toroid - 8.4 MHz
c -- annealed wound toroid - 8.4 MHz
d -- temperature compensated - 7.6 MHz
e -- re-wound toroid -6.25 MHz

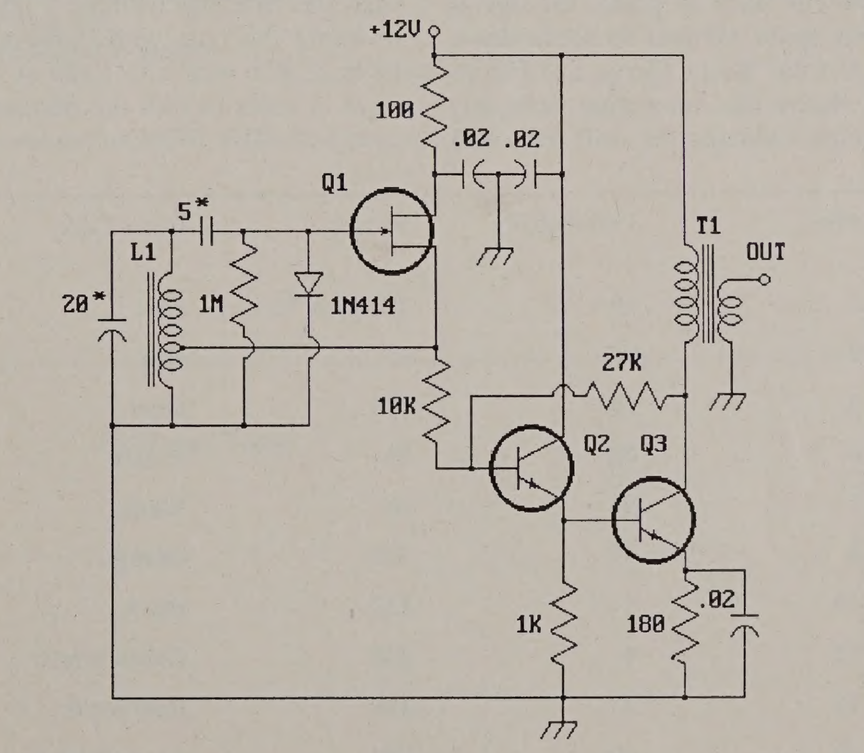
Figure 3. Drift at 8.4 MHz

kHz at 5.5 MHz equals 364 ppm. Notice that the frequency decreased, which is typical of most drift measurements taken from a cold start. Most inductors and capacitors have a positive temperature coefficient; they increase in value with increases in temperature, causing a decrease in frequency. When the circuit is first turned on, power is dissipated in the circuit elements, causing them to heat up. Eventually they reach a temperature where the added power is dissipated to the surroundings at a steady rate and no further temperature increase occurs. Most of the increase occurs during the first ten minutes and is repeatable if the circuit is turned off for a few hours to allow it to return to room temperature and then turned on again.

The Inductor

After reading the excellent article by Lewallen [1], I suspected the inductor may be causing most of the drift shown on the top curve of Figure 2 and decided to replace it with a toroidal core. Table 1 lists the properties of the various mixes of powdered iron cores, including the stability or temperature coefficient. Mixes 6 and 7 are the best choices for a stable inductor. If the slug were made of type 3 mix, then a 2° C temperature increase would be enough to cause the 2 kHz shift.

A T50-6 core was wound with twenty-five turns of #26 copper enamel wire. After replacing the slug-tuned coil with this toroid, the turns were adjusted to bring the frequency to 5.5 MHz. The circuit was allowed to settle down with no power for several hours and the drift was measured again. The bottom trace of Figure 2, which is



* -- NPO ceramic capacitor
L1 -- 31 T #26, tap at 6 T on T50-6 core - anneal
Q1 -- MPF102
Q2,Q3 -- 2N2222
T1 -- primary 25 T #25, sec. 5 T #26, on FT37-43 toroid core

Figure 4. 8.4 MHz VFO

shifted down 1 kHz for clarity, shows the result -- no improvement. Obviously the inductor is not the main cause of drift in this circuit. Perhaps the silver mica capacitors or the collector capacitance of the CA3028 transistor directly across the tuned circuit are responsible.

The Circuit

Lewallen [1] recommends the circuit shown in Figure 4. Its drift performance was measured at a frequency of 8.4 MHz and is shown in curves a and b of Figure 3. As mentioned earlier, this warm-up drift of 865 Hz at 8.4 MHz (103 ppm) is very repeatable.

Annealing the Wound Inductor

I unsoldered the coil and placed it in boiling water for five minutes to "anneal" it. After re-soldering the coil back in place, the circuit was again allowed to settle down for a few hours. Curve c of Figure 3 shows that annealing definitely helps, reducing the drift from 865 Hz to 676 Hz at 8.4 MHz (80 ppm).

Negative Temperature Coefficients

I was able to reduce the drift significantly by replacing the 20 pF NPO capacitor of Figure 4 with a 40 pF N220 capacitor in parallel with a 10 pF NPO. This dropped the operating frequency to 7.6 MHz. Drift decreased to 332 Hz (44 ppm) as shown in curve d of Figure 3. Apparently the negative shift of capacitance is canceling the positive shift in the inductor. Further reduction should be possible with a more negative capacitor. I would next try a 40 or 39 pF N270.

Rewinding an Annealed Wound Inductor

It seems that annealing is more significant for the core material than the windings because I later rewound this core with thirty-one turns of #26 wire with a tap at six turns in order to shift the frequency to 6.25 MHz. Without reannealing, the drift performance did not change (see curve e of Figure 3). The drift of 273 Hz at 6.25 MHz (44 ppm) is identical to the annealed wound inductor above.

Mix	Permeability	Stability	Color Code
1	20	280 ppm/° C	Blue
2	10	95	Red
3	35	370	Gray
6	8.5	35	Yellow
7	9	30	White
8	35	255	Orange
10	6	150	Black
12	4	170	Green/White
15	25	190	Red/White
40	60	950	Green/Yellow
41	75	975	Green
44	90	1025	Black/White

Table 1 Properties of Magnetic Toroidal Cores

Recommendations

The most important factors in reducing drift in home-brew VFO's seem to be to select components with very low temperature coefficients for the tuned circuit and to use a low drift circuit. Inductors should be wound on type 6 or 7 toroid cores, then placed in boiling water for five minutes before soldering into the circuit. For capacitors, start with NPO types and then replace part of the NPO with just enough negative temperature capacitance to cancel the effect of the positive drift of the inductor. You'll have to make several drift measurements with various values to get the right amount. A low drift circuit such as the one in Figure 4 is also recommended.

I hope this empirical information will encourage other hams to build into their equipment the kind of high stability VFO's we find in commercial gear. I'd also be interested in hearing from others about their experience. Good luck and start building!

References

1 Roy W. Lewallen, W7EL, "An Optimized QRP Transceiver," *QST*, August 1980, page 14. Also Feedback, *QST*, November 1980, page 53.

John Pivnichny is an engineering manager in the data processing industry. Licensed since 1956, he can be found on all HF during contests working CW, SSB, or RTTY. At other times John likes to experiment with amateur radio circuits in his home workshop at 3824 Pembrooke Lane, Vestal, NY 13850.

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____

E. Are you planning to buy communications gear within the next year? ☐ Yes ☐ No
Type ______________________________
____

F. When did you last buy communications gear?
____

G. What type of equipment do you own? (Check all that apply, then circle the one used most often.)

	Brand	Age
☐ Receiver	____________	_____
☐ Transmitter	____________	_____
☐ VHF/UHF hand-held	____________	_____
☐ VHF/UHF transceiver	____________	_____
☐ HF transceiver	____________	_____
☐ Beam antenna	____________	_____
☐ RF power amplifier	____________	_____
☐ Computer	____________	_____
☐ Mobile rig	____________	_____
☐ Other	____________	_____
☐ None at present		

H. Operating modes used: (Check all that apply, then circle the mode used most often).

☐ CW ☐ SSB ☐ Packet ☐ TV
☐ RTTY ☐ FM ☐ Satellite ☐ AM

I. Bands Used: (Check all that apply, then circle the band used most often).

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   ☐ General

2) ☐ Planning to obtain an amateur license

3) ☐ Short Wave Listener

4) ☐ Electronics Hobbyist

B. How many other people in your household are interested in this same hobby? __________

C. Do you work in the electronics industry?
☐ Yes ☐ No

D. What is your occupation? ______________
____

E. Are you planning to buy communications gear within the next year? ☐ Yes ☐ No
Type ______________________________
____

F. When did you last buy communications gear?
____

G. What type of equipment do you own? (Check all that apply, then circle the one used most often.)

	Brand	Age
☐ Receiver	____________	_____
☐ Transmitter	____________	_____
☐ VHF/UHF hand-held	____________	_____
☐ VHF/UHF transceiver	____________	_____
☐ HF transceiver	____________	_____
☐ Beam antenna	____________	_____
☐ RF power amplifier	____________	_____
☐ Computer	____________	_____
☐ Mobile rig	____________	_____
☐ Other	____________	_____
☐ None at present		

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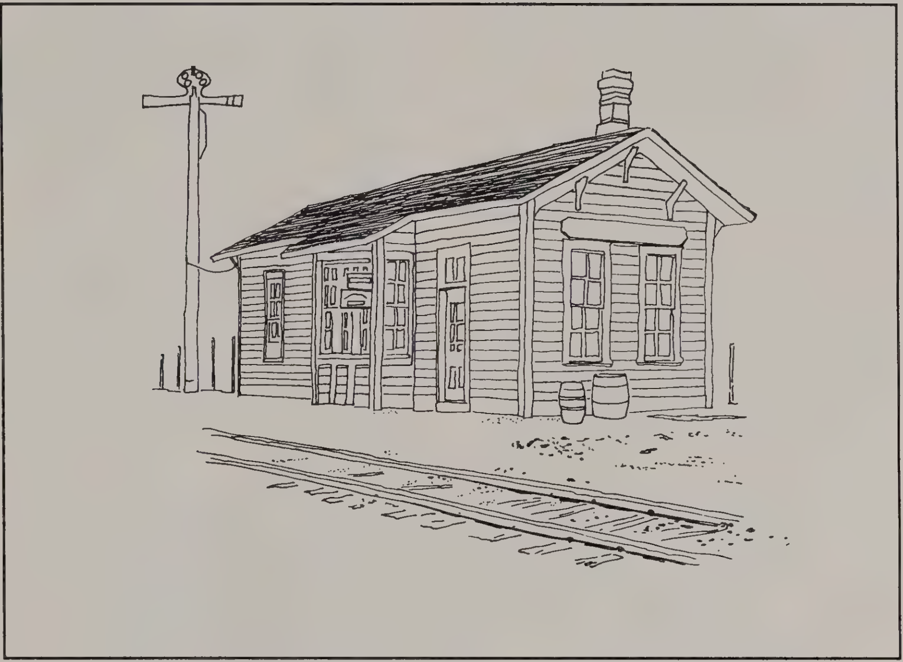
A Key to the Past

by **Bob Cutter, KI0G**

I first saw it from the sidewalk, back in the far corner of a low window display. Everything in the window was covered with dust, and all the price tags and information cards were faded in the sun. It was sitting next to a Fada AM receiver of blue marbled plastic with a bright yellow circular dial and yellow plastic handle on top. But my eye was drawn from the antique radio to it -- a utilitarian piece of equipment, just a tool for some long-forgotten operator.

I tried the shop door and found it locked. However, a sign inside the glass door said, "Gone to lunch, back at 1." It was 10:30 in the morning. It seemed unlikely but I decided to take the message at face value and try after lunch. The town was not that big so I was soon finished exploring and still left with considerable time to kill. Like so many small towns, this one had a park and I found a vacant bench in the shade.

The town was in southern Colorado, not an area noted for economic good times, and I had begun to speculate and daydream on how it might have ended up in the window of this antique-junk shop. Probably traded from some other dealer's stock, part of a wholesale package deal. Still, the shop looked pretty dismal and I guessed this dealer didn't go to many antique shows and did not appear to have much of what other dealers would want. More likely it was part of what was included in the catch-all description, "estate sale."



We were thousands of miles from the ocean or inland waterway so it was doubtful it had belonged to a seagoing op. The railroad went through here thirty years ago -- it might have belonged to a third trick agent-operator-baggage handler-janitor, as the job description went in those days. Sometimes the job included the delivery of bad news. I wonder if it had figured in any "----regrets to inform you ----" messages that hit so many small towns, even here in southern Colorado years ago. It must have shared some good news also, at least I hoped so as I sat waiting and dreaming in the park.

I knew it was a landline instrument since I saw the shorting knob and lever on the right side. I could even see the arc that the lever left on the base when it was switched in and out of the circuit. It could have been used in the Western Union system.

Maybe it spent its earlier life making the railroads work, passing the trivial parts of the whole which made up the greatest transportation system of its kind in the world. Messages such as:

Ridgway April 18, 1923
Conductor No 6

If Mrs W.M. Virden, wife of fireman, is on train take her to Telluride on pass No. 223. Get pass at Durango on your return.

C.B. Carpenter. . .315p

It could have migrated north and west from the great oil and gas pipelines of Texas and Oklahoma where it would have spent its time passing information on compressor stations and production schedules.

Mining was an important part of the history of this part of the country. Perhaps it figured in messages such as "FLANJANY" which, according to "Western Union Telegraphic Code" (Universal Edition) 1900, was number 47967 and meant "at what do you estimate the cost of mining?"

Time's up! It was past one. Funny how time could fly by. I walked through the park, crossed the street in the middle of the block and noticed that the sign was still on the door, but I thought a light was on where there had been none before. The door was unlocked and a bell gave a pleasant but all-too-loud announcement of a customer. I would have preferred to scout the place out a bit more on the inside to plan my approach for the possible transaction.

A lady came out of the back room. She had on gloves, the white garden kind but not white anymore.

"This was my husband's store," she said, "sort of a hobby of his, and I am trying to get the stuff ready for a dealer who is sending a truck up from Sante Fe. Supposed to be here in the morning. Can I help you?"

"I'm sort of interested in something in the front window. . ."

"Help yourself. I don't know much about this stuff. I was afraid you were another one who left something with him on consignment. Fred wasn't too keen on records. I'll be in the back if you need me."

I went to the front of the shop, reached over the back of the window display and felt the solid compact weight that only a bug has. The contacts and damper were rattling as I lifted it up and over. I immediately regretted blowing the dust off, but my eyes and nose soon returned to normal. There it was: "The Vibroplex Company, Inc., 796 Fulton St., Brooklyn, NY No. 109445." The base was black enamel with traces of gold pinstriping at the corners. The square weight was at the midpoint, and when I put the bug down and moved the paddle to the right, it gave off a string of dits, just like it had been waiting for someone to do that for a long, long time. The fingerpiece was worn and slightly bent to the right; the points of contact with the op's fingers were smooth and shiny. It had seen some good honest use. One of the binding post nuts was brass and the other was silver color like the rest of the pieces. It looked complete even to the three, now-hard rubber feet on the bottom. It felt good in my hand.

Now the moment of truth. I walked to the rear of the shop and she saw me the minute I came through the door to the back room. She had several boxes full of items and several piles. I could not figure out the differences between the piles and decided not to ask.

"Did you find what you were looking for?" she asked.

"Yes. What are you asking for this?" I replied holding out the key in my hand.

"I don't remember where Fred got that from. It was used for telegrams you know."

"Yes, I know. What will you take for it?"

"Oh, I don't know. What will you give?"

Then again it may have spent its earlier life calling "CQ, CQ, CQ," which is what it does now from time to time.

Bob Cutter and his bug live at 701 19th St., Glenwood Springs, CO 81601.

ELMER

by Rich Regent, K9GDF

TWEEE EEE...
EEEEET!
WHY DON'T YOU USE A DUMMY LOAD?
I AM... YOU'RE IT!

Field Déjà Vu

by John Telford, W3TJ

"CQ Field Day W3VA Field Day."

"W3VA, do you copy W3TJ?"

"Roger W3TJ, this is W3VA alpha in EPA."

"Roger W3VA, this is W3TJ one echo in EMA. What is your field day QTH in EPA?"

"Oh, we are way up in the mountains. You couldn't find us on a map -- some place called Delano Fire Tower."

"Thanks, OM, and good luck in the contest."

That operator might have thought no one knew where his Field Day QTH was, but that was not the case on my end. Delano Fire Tower -- what a memory indeed!

I guess the year would have to have been about 1949. My father woke me up early on a Sunday morning before dawn. Without telling me much, he proceeded to drive us both over hill and dale through the densest, coldest fog I had ever seen to some place high on a hill. As we left the car in the fog and walked a bit, I saw some army tents take shape in front of us. An old ill-running generator broke the silence of the fog.

Inside one of the tents we found some warmth, both in the heat of the tent and in the company of men who knew my father. Set up on tables was a fantastic array of radio equipment. Mostly war surplus, it was definitely hastily interconnected. Open wire feeders ran skyward through holes in the tent. Occasional blue arcs formed when raindrops ran down the insulators. As I listened to the operators in their positions I heard contacts with all sorts of other stations.

We moved from tent to tent and saw different positions and different radio setups. Somebody put a large tin cup filled with homemade bean soup and crackers in my hand and said "Sit here." Now, I was nobody to these men. But they were having a good time and they wanted to share it. As I sat on the bench looking at a very complicated radio, eating a delicious cup of soup on a cold morning, and generally feeling the intensity of the moment I could not help but think how wonderful amateur radio was. Forty years later, the same feeling is still with me.

Our future lies with the young hams-to-be. It's important to us all to take the young ones with us to Field Days and hamfests and to visit other hams. They might not say much at the time, but you will be building unforgettable memories and perhaps starting some young people on a lifelong adventure.

John Telford now lives in Swampscott, MA, and teaches computer science at Salem State College. Son John, third ham generation, got his technician ticket this fall.

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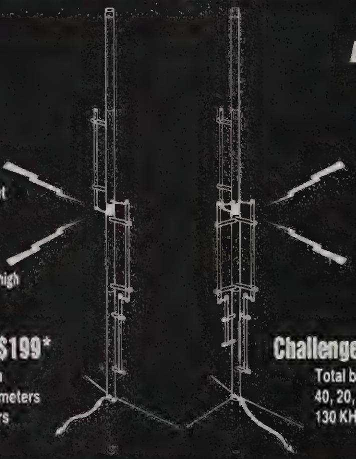

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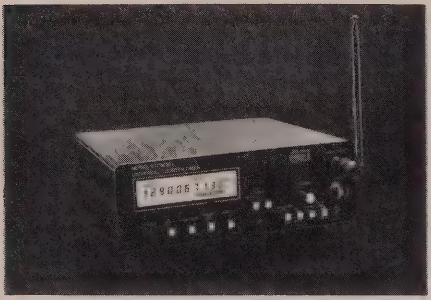
PRODUCT NEWS

Counter-Timer

Optoelectronics Inc. has a new universal counter-timer, Model UTC 8030, that is both a benchtop frequency counter and a portable frequency finder.

As a benchtop counter-timer for use in a lab, it makes direct and prescaled frequency, period and time interval measurements, and calculates and displays frequency ratios. Display resolution is 1 Hz in 600 MHz with a 4-second gate time. UTC 8030 also has both a 50-ohm "A" input for signals above 10 MHz, and a 1-megohm "B" input for signals below 50 MHz. Uncommon in such a low-cost instrument, signal conditioning controls let you make the counter count exactly what you want it to count. Preset or adjustable over a ± 2.5 volt range, variable trigger control is critical for eliminating jitter and other effects of noise when measuring periods and time intervals.



As a portable frequency finder for use in the field, UTC 8030 features an extremely wide dynamic operating range, spec'ed from 10 Hz to 2400 MHz (useful from 1 Hz to over 3000 MHz). Sensitivity is spec'ed better than 1 mV up to 500 MHz (0.1 mV typical), and better than 10 mV at 2400 MHz.

UTC 8030 is priced at $579. Optional ± 0.1 PPM time base is $125; NiCad battery pack is $75; LCD backlight is $40. All are available from stock.

For more information on this and other personal rf instruments, contact Bill Owen at: Optoelectronics Inc., 5821 N.E. 14th Ave, Fort Lauderdale, FL 33334. Phone (800) 327-5912 or FAX (305) 771-2052.

Linear Amplifier

Ameritron announces the release of AL-811, a 600-watt linear amplifier for only $599.

It uses three 811A tubes to deliver 600 watts PEP or 500 watts CW from 160-10 meters. A Pi-network tuned input circuit matches the tubes to 50 ohm exciters. A vernier reduction drive on the plate control makes tuning precise and easy.

The rugged 811A tubes feature fast 3-second warm-up time and extremely low replacement cost. Pressurized ventilation keeps tubes and power supply components at temperatures safely below manufacturer's ratings, even when operating continuously at 600 watts. Weight is only 30 pounds and size is 16 x 13-3/4 x 8 inches.

Contact: Ameritron, 116 Willow Rd., Starkville, MS 39759 or call (800) 647-1800 for full line catalog.

3-in-1 Panel Meter

The APM70W Series of analog panel meters from D1 International perform the functions of three separate meters by reading DC volts, DC amps and watts off of a single dial face. Two separate meter movements within the same case allow continuous and independent reading of DC voltage and current. Where the volt and ammeter needles intersect, DC power consumption in watts can be read directly from the calibrated dial.

These features simplify the simultaneous monitoring of all power load parameters. Panel space requirements are minimized considerably since only one meter is used in place of three.

Three standard APW70W series are offered having full-scale current ranges of 0-5 , 0-15, and 0-30 amps DC having corresponding power readings of 150, 250 and 500 watts. Voltage readings for all standard meters are 0-30 volts DC full scale. Price is $39.50, or the equivalent of $13.67 per meter function.

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Send your product news to:
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The Junk Box Cathode Modulator

by Charlie Tiemeyer, W3RMD

If you have built a "junk box" transmitter or bought an old DX-35 at a hamfest, you may now wish to "modulate" it. With this simple circuit you can do just that. It will be AM modulated but it will enable you to at least work low-power phone. Contrary to popular belief, AM is still around and thriving, especially on 75 meters and the upper 10-15 kHz of 40 meters.

Previous articles have been written on cathode modulators, all basically derived from an antiquated "hints & kinks" publication by ARRL entitled, "The Simplest Modulator." Then in May 1964, *73* magazine published an article entitled, "The Gardner Modulator Revisited." It updated the 6SL7 speech amplifier to a 12AX7 but still retained the 6Y6 modulator.

On the above premise, most junk boxes still contain the above-mentioned tubes. However, while I still retained the 12AX7, I had better output utilizing a 6DQ6 instead of a 6Y6. If you built the junk box transmitter, no doubt you will have 6DQ6's available or you can use any tube as in the rig's final. It should perform okay. Socket connections for both 6Y6's and 6DQ6's are identical except the 6DQ6 uses a plate cap which can be supplied with a lead through your chassis. Incidentally, my cathode modulator is built on a 6 x 4 x 2-inch aluminum chassis, but anything you have available of a reasonable size will do nicely.

It is only necessary to keep all leads short which go to the first speech amplifier stage and to shield the lead from the microphone connector on the grid of the 12AX7. If RF feedback occurs, it may be necessary to filter the input circuit with a 0.001 μf disc ceramic capacitor to ground and an RF choke in the grid lead. I had to do this. Figure 1 shows the schematic diagram and parts.

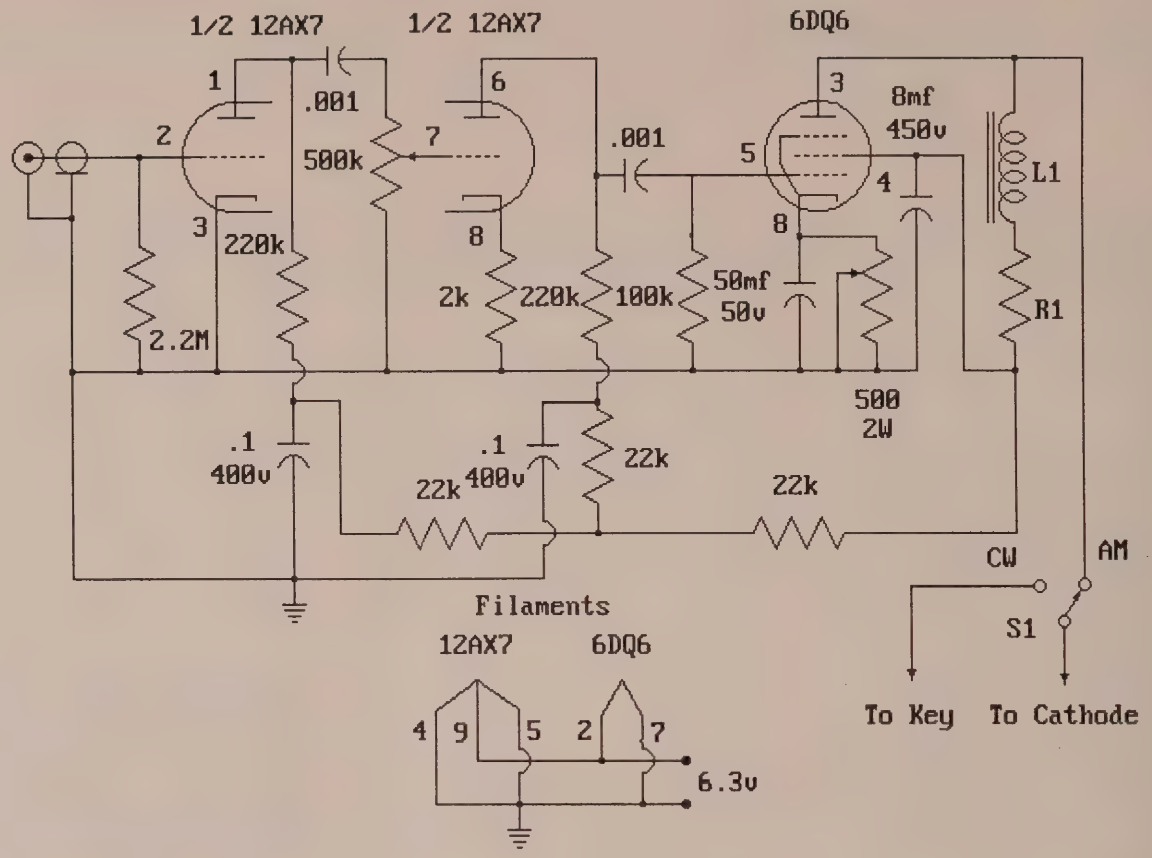
To use the modulator, simply tune and load the transmitter for CW operation. Then plug the modulator into the key jack as the rig is cathode keyed, but don't forget to turn its filaments on first. If you don't, you could damage your 6Y6 or 6DQ6 by applying plate voltage. The plate current should drop to about half its CW value. Then talk -- that is all there is to it.

The RF amplifier plate current should remain steady except possibly for a slight flicker on voice peaks. The 500-ohm, two-watt potentiometer is used to control plate current and should be adjusted in conjunction with transmitter loading until upward modulation occurs. The forward deflection of my SWR meter and the rig's plate current meter kick upward slightly when talking. Should a scope be available, it is excellent to check modulation. Make sure that the maximum screen voltage of a 6Y6, if used, does not exceed 135 V or 150 V for a 6DQ6 screen, and the plate voltage of the 12AX7 does not exceed 300 V. Be sure to check these voltages on standby as well as full loading of the transmitter since on occasion these could be exceeded and you would be wondering where all the 6Y6's or 6DQ6's are going.

I use a 6DQ6A which easily handles 150 V with the junk box rig or my well-modified Globe Chief 90A. The Globe Chief power supply furnishes between 515 V and 580 V, depending upon how heavy I load it, and I have encountered no problems whatsoever in the past twenty years. It works beautifully. The more husky your power supply is, the more output you will achieve in the AM mode. However, you don't want to overload your rig's final amplifier tubes with too much voltage; otherwise they won't last very long.

Don't expect your rig to set the world on fire using AM with the cathode modulator, but you will at least be on phone. You will also be pleasantly surprised at some of the nice signal and audio reports you will get.

I use either an Astatic D-104 or a Turner VT-73 crystal microphone, but any good crystal microphone should do a creditable job for you. Cathode modulation sounds like high-level Class B modulation and your S-meter kicks upward slightly also. Screen or control grid modulation is only capable of about 33 percent efficiency; Class B modulation falls midway between the two, or approximately 50 percent efficiency.



L1 - Any small audio choke, 2 henries or more on the plate side of a small output transformer.

R1 - Nominally 200 ohms, 2 W. Adjust to higher value if 6Y6 screen voltage exceeds 150 V. NOTE: I did not have to use this resistor as my voltage wasn't anywhere near 135 V or 150 V.

All resistors are ½ W unless otherwise indicated.

I used disc ceramic capacitors, 600 V (whatever) for the coupling and bypass capacitors. You can also use 400 V paper too.

Figure 1. Cathode Modulator Schematic Diagram

Hence, if you don't tell anyone you're not plate modulated, they will never know.

Charlie Tiemeyer has been a ham for 40 years and married for 46 years (to Bettye, K3VRZ). Now retired from G.E., Westinghouse, and the U.S. Postal Service, he and Bettye enjoy traveling to hamfests from their home near Chestertown, MD.

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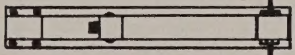

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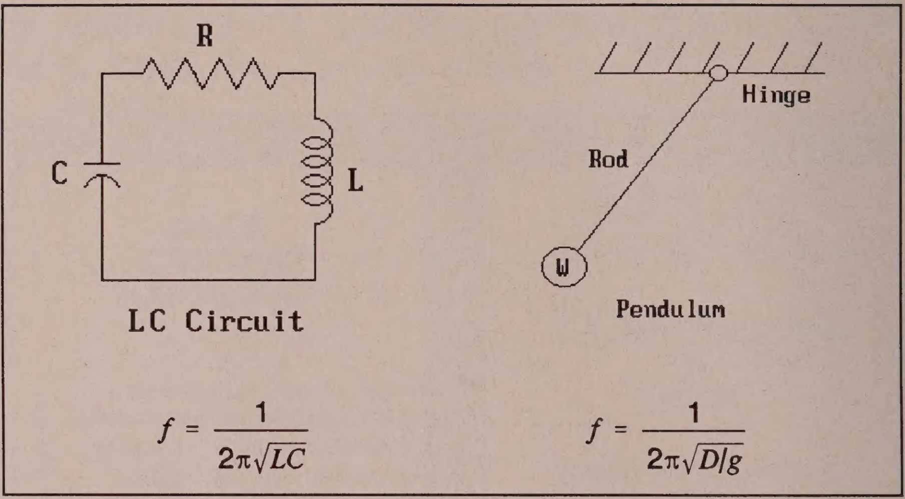
BACK TO BASICS

Resonance

by Bill Richardson, W3IMG



$$f = \frac{1}{2\pi\sqrt{LC}}$$

$$f = \frac{1}{2\pi\sqrt{D/g}}$$

Figure 1

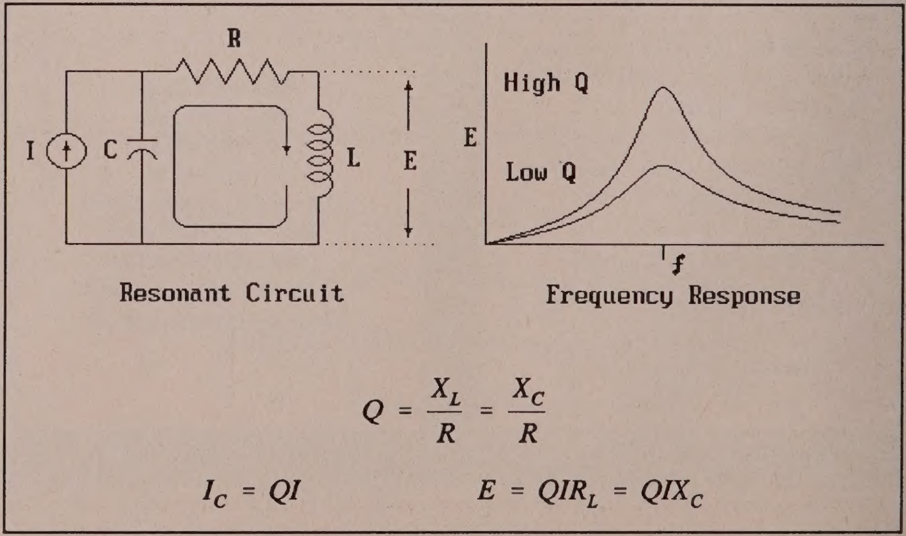
Resonance is the increase of the response of a circuit to a repetitive driving signal when the frequency of the signal equals the natural frequency of the circuit. Resonance of an LC circuit is difficult to understand. The pendulum is the mechanical analogy of the LC circuit and is very useful in explaining its properties.

When a capacitor and inductor are connected as in Figure 1, the resonant frequency of the circuit is the frequency at which the reactance of the capacitor equals the reactance of the indicator. Resistor R represents the losses in the components and any external loading. Q is a measure of the selectivity of the circuit.

The parallel resonant circuit is usually driven by a constant current source. Its output varies with frequency as shown in Figure 2. The resonant frequency is f. The higher the Q, the greater the slope and the greater the output. At resonance the circulating current is a maximum. As the frequency of the signal deviates from the resonant frequency, the output decreases. Thus, resonance permits the generation and amplification of a specific signal while rejecting others.

The pendulum consists of a rod hinged at the top and having a weight W attached at distance D from the hinge. Its resonant frequency is dependent on the length of the rod , D and g -- the acceleration of gravity, which is nominally 9.8 meters/second/second. Note the similarity to the formula for the resonant frequency of the LC circuit. For a given force driving the pendulum back and forth, the swing will be greater at its resonant frequency than at other frequencies. This is similar to LC resonance. The equivalent R of the pendulum is the friction of the hinge and air resistance.

When a pendulum is at the top of its swing (see Figure 3), all of its energy is potential energy. At the bottom of its swing all of its



$$Q = \frac{X_L}{R} = \frac{X_C}{R}$$

$$I_C = QI \qquad E = QIR_L = QIX_C$$

Figure 2

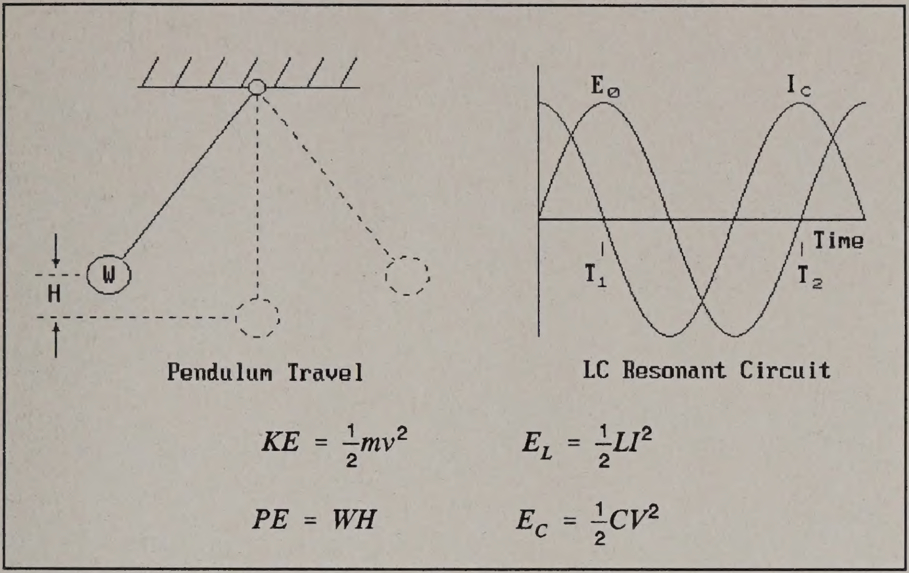


Figure 3

energy is kinetic. Figure 3 depicts the voltage -- current relationship in the LC resonant circuit. At time T1 when the current is zero and the voltage a maximum, all of the energy is in the capacitor. At T2 when the current is maximum and the voltage is zero, all of the energy is in the inductor. Thus both the pendulum and LC circuit have two energy states when oscillating.

If one gives a pendulum a single shove, it will oscillate at its resonant frequency but with decreasing amplitude. The greater the friction, the faster the decay. If one drives a resonant circuit with a single pulse, it also will oscillate at its resonant frequency with decreasing amplitude. The greater the R, the faster the decay. This is called ringing, and receivers can be desensitized in this way when subjected to pulse interference.

If the pendulum is momentarily nudged each time it reaches a given point of its travel, it will continue to oscillate at its resonant frequency. If it is nudged only every second cycle, it will still oscillate at its resonant frequency which is twice the driving frequency, but the deviation will be less.

If the LC circuit is pulsed at a given point in its cycle, its output will be a sine wave at its resonant frequency. This is the way in which a Class C amplifier operates. If it is pulsed every second cycle, its output will be a reduced sine wave at its resonant frequency. This is the way a frequency doubler operates.

If a force is applied to the pendulum at point A (Figure 4) on the rod, it will take more force and less travel to maintain a given amplitude of oscillation than if the force is applied at point B. Similarly, in an LC circuit for a given output, it takes more current and less voltage if driven at A than if driven at B. For both the pendulum and LC circuit, the power required is the same for a given output regardless of the drive point.

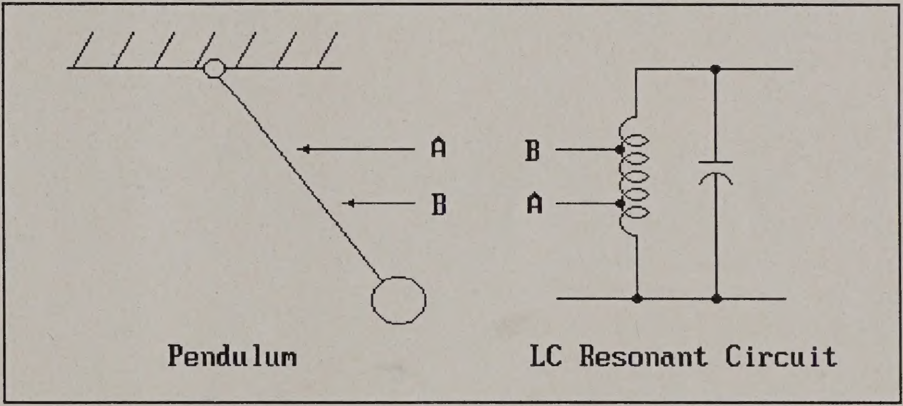


Figure 4

Two resonant circuits at the same frequency can be coupled together for greater selectivity. This is the equivalent of the pendulums shown in Figure 5.

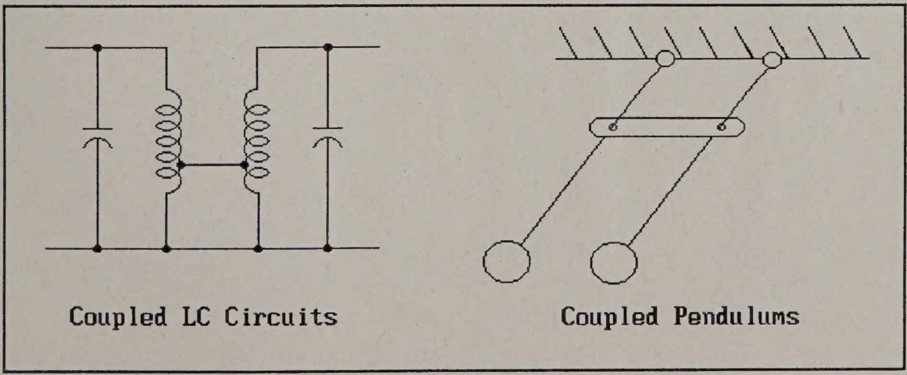


Figure 5

The next time someone asks you how a resonant circuit works, build them a pendulum and show them.

Bill's QTH is 3333 Harness Creek Rd., Annapolis, MD 21403.

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Triple Play!

TM-941A

TRI-BAND FM Transceiver

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- **DTU-2** Digital paging (DTMF) unit
- **PG-4K, PG-4L** Front panel cable kits
- **MC-45** Multi function mic.
- **MB-11** Extra mounting bracket
- **SP-41, SP-50B** External mobile speakers
- **PG-3B** DC line noise filter
- **PS-430** Power supply
- **PG-2N** DC power cable.

Complete service manuals are available for all Kenwood transceivers and most accessories.
Specifications, features, and prices are subject to change without notice or obligation.

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